Trends

North Carolina Institute for Climate Studies

Inspire. Advance. Engage.

Winter 2017/18

Who We Are

Hosted by North Carolina State University, NCICS is a unique center of excellence showcasing a partnership between universities, the private sector, non-profit organizations, community groups, and the federal government.

NCICS' primary activity is the operation of the Cooperative Institute for Climate and Satellites–North Carolina. CICS-NC is a multidisciplinary team of experts who collaborate in climate and satellite research to support NOAA NCEI's "research to operations" strategy.

Our Vision

- NCICS ***inspires*** cutting-edge research and collaboration.
- NCICS ***advances*** understanding of the current and future state of the climate.
- NCICS ***engages*** with business, academia, government, and the public to enhance decision making.

Main Research Activities

Access and Services Development

Climate Assessments

Climate Data Records and Scientific Data Stewardship

Climate Literacy, Outreach, Engagement, and Communications

Surface Observing Networks

Workforce Development

Consortium Projects

NOTE FROM THE DIRECTOR

Welcome to the Winter 2017/18 issue of *Trends*! We've had a very productive year with growth in multiple dimensions.

Kenneth Kunkel, Jenny Dissen, and NCEI Technical Support Unit Director David Easterling led the U.S. delegation at the U.S.–India Partnership for Climate Resilience Workshop on Development and Application of Downscaling Climate Projections, which took place March 7th–9th at the Indian Institute for Tropical Meteorology in Pune, India. Closer to home, Carl Schreck and Kerry Emanuel (MIT) co-hosted the May 22nd–23rd Tropical Cyclone Reanalysis Workshop at The Collider here in Asheville.

The Institute sponsored a short course in R programming for Climate Data Analysis and Visualization on May 30th–June 2nd, taught by Dr. Samuel Shen, San Diego State University Distinguished Professor. Over the course of the year, Institute team members taught an NC State University distance education course, led various panels and webinars, and gave presentations at many regional and national scientific and professional meetings, including the June 26th–28th American Meteorological Society 23rd Conference on Applied Climatology in Asheville.

June marked major progress in the NOAA Big Data Project, with the near-real-time distribution of GOES-16 data. In November, new national climate assessments were released, including the Climate Science Special Report (officially, Volume 1 of the Fourth National Climate Assessment) alongside the public review draft of Volume 2, which focuses on impacts, risks, and adaptation efforts. Institute peer-reviewed publications included cutting-edge science highlighting new approaches to deep learning algorithms.

The August 21st solar eclipse provided numerous outreach and educational opportunities; our website, featuring a climatological forecast of expected viewability, garnered national media attention and more than 300,000 views. Institute staff gave numerous invited interviews on this and many other climate topics during the year. Our Outreach Team also stayed busy interacting with hundreds of K–12 students on multiple climate and weather topics in 2017.

Our efforts were recognized at many levels this year, and two Institute staff members—Linda Copley and Lou Vasquez—were named as NOAA NESDIS 2017 Outstanding Information Technology and Engineering Employees of the Year.

Finally, we welcomed Mary Wohlgemuth as the new NCEI Director and look forward to working with her.

We appreciate your interest in the Institute and look forward to helping you and your stakeholders address the impacts of environmental change.

— Otis Brown, NCICS Director

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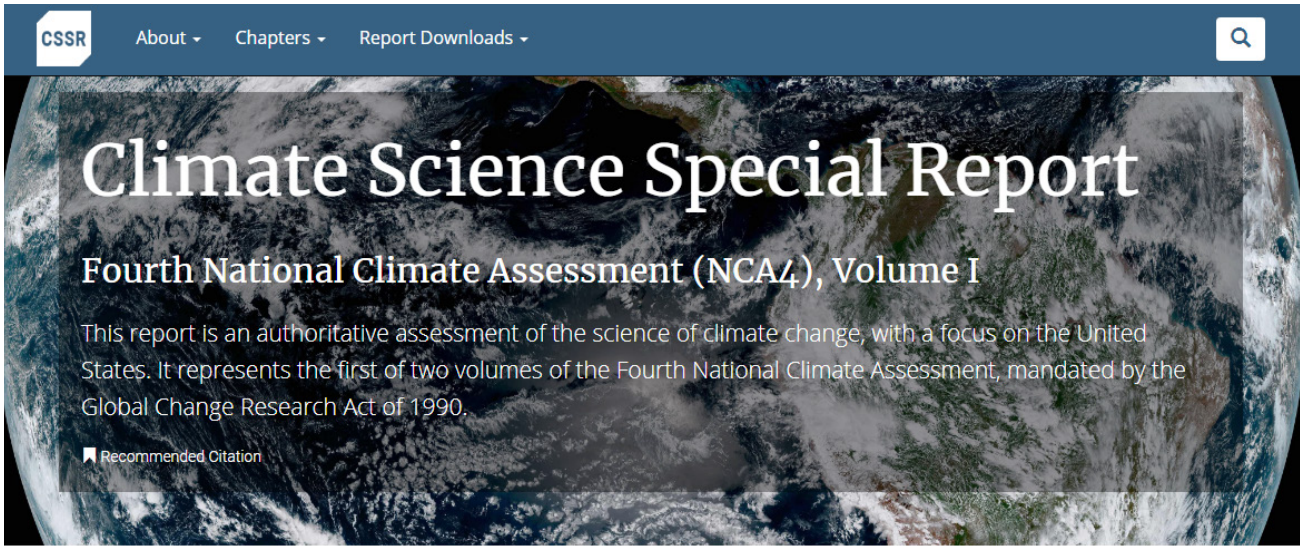
National Climate Assessment Reports Released

On November 3, 2017, the U.S. Global Change Research Program (USGCRP) released two components of the federally mandated Fourth National Climate Assessment:

- *Volume I: The Climate Science Special Report* (CSSR), and
- A draft version of *Volume II: Climate Change Impacts, Risks, and Adaptation in the United States*. This draft is available for public review and comment.

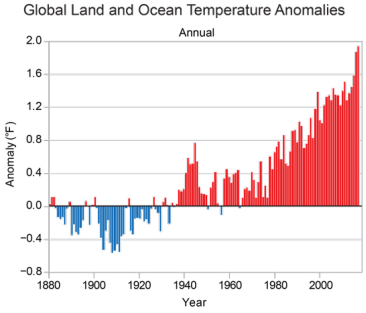
Working as part of NOAA's Assessments Technical Support Unit (TSU), scientists and other experts from CICS-NC played key roles in the development and release of both reports. The Climate Science Special Report is available as a website and as downloadable PDF files at https://science2017.globalchange.gov

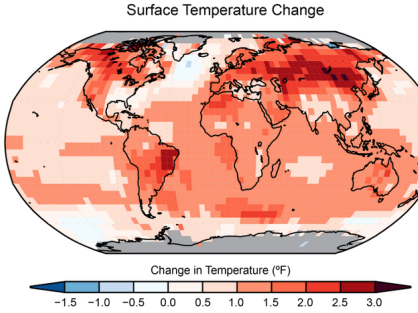


Institute scientists made significant contributions to the climate science results presented in both volumes, including the development of several figures showing observed and projected changes in key aspects of Earth's climate system. Communications experts served as technical editors and contributed to the development of many of the scientific figures and infographics in both reports as well as the layout of the PDF version of the final CSSR report. Web developers and software engineers contributed to the design and development of the interactive CSSR website, which allows you to read content, view figures, and share findings on social media. Data experts and software engineers helped ensure openness and transparency by facilitating the collection and delivery of metadata for all the figures in the CSSR.

This work builds on contributions to previous USGCRP reports, including the *Third National Climate Assessment* released in 2014 and the *Climate and Health Assessment* released in 2016.

The team will be hard at work over the next year on the continuing development of NCA4 Volume II, which is scheduled to be released in December of 2018. To read and comment on the draft version of Volume II, go to: https://review.globalchange.gov



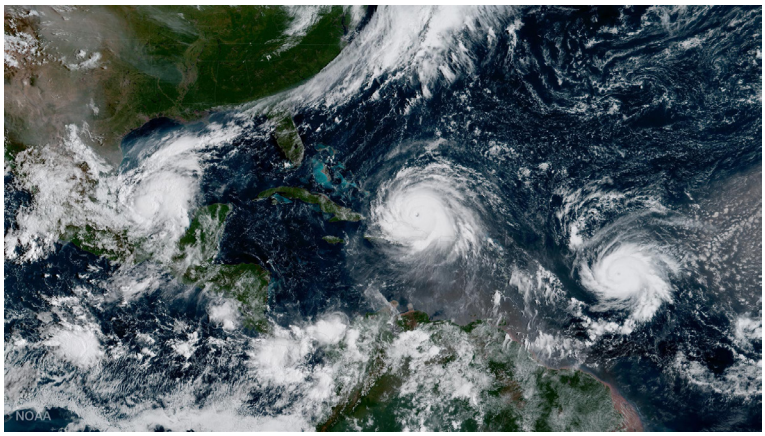


GOES-16 Data in the Cloud

Providing Unprecedented Public Access to GOES-16 Data

NOAA's new geostationary weather satellite, GOES-16, launched in November 2016, is already changing the way we view our planet. By providing images and data at much higher resolutions and higher frequencies than its predecessors, GOES-16 gives weather forecasters and other scientists a much more detailed view of the Earth system than was previously possible. As part of its ongoing support for NOAA's Big Data Project, CICS-NC is helping provide unprecedented public access to GOES-16 data and images.

The Big Data Project aims to expand access to important data sets by making them available to the public at no charge through partnerships with a variety of cloud providers. This allows individuals and organizations from both the public and private sectors to analyze massive quantities of data without having to provide their own storage and data transfer infrastructure. They can work with the data directly in the cloud, using the computing resources and software tools (both open-source and proprietary) provided by the various cloud services.



GOES-16 image from September 7, 2017, shows Hurricanes Irma, Jose, and Katia.

Building on our success in porting NEXRAD Level II radar data to the cloud, CICS-NC has been delivering near-real-time GOES-16 data to three public cloud providers—the Open Commons Consortium's Environmental Data Commons, Amazon Web Services, and Google's Cloud Platform—since June of 2017.

Using processes developed by CICS-NC's IT team, led by Jonathan Brannock, the data are downloaded to the Institute's high-performance computing infrastructure from NOAA's internal data distribution center, packaged for distribution, and transferred to the cloud providers, all in a matter of a few minutes. We are currently transferring approximately 350 Gigabytes of GOES-16 data each day, or about 10 Terabytes of data each month.

The GOES-16 data available on the cloud include a range of "Level 1b" and "Level 2" products generated from the 16 channels on GOES-16's primary observing instrument, the Advanced Baseline Imager, or ABI. The ABI provides two channels of visible light data and 14 channels of near-infrared and infrared (IR) data. In addition to providing images of clouds, storms, and other weather phenomena, these products provide data on vegetation cover, snow and ice, and ocean temperature. The products range from images of weather systems taken every 30 seconds to images of the continental United States taken every 5 minutes and "full disk" pictures of the western hemisphere taken every 15 minutes.

Although GOES-16 wasn't declared fully operational until December 18, 2017, it already demonstrated its value during the record-breaking 2017 Atlantic hurricane season. For example, as Hurricane Maria approached Puerto Rico, the land-based radar in San Juan went offline, leaving forecasters without a crucial source of data. GOES-16 helped fill that information gap, allowing forecasters to track the storm using GOES-16's high-resolution images of the storm taken up to every 30 seconds.

Other organizations are also taking advantage of cloud-based access to GOES-16 images. The Tampa Bay Times recently used GOES-16 data pulled from the Open Commons Consortium portal to explain, in a very visual and clear manner, how and why Hurricane Irma tracked up through the center of Florida rather than taking an even more damaging course along the east or west coast of the state. That web story is available at: http://www.tampabay.com/projects/2017/hurricane-irma/matter-of-miles.

Educational Outreach

Fall is a busy time of year for outreach, with NCICS receiving many requests from local schools, universities, and other public organizations. Volunteers participated in twelve unique activities throughout Western North Carolina from September through November, involving more than 400 students in grades K–12 as well as college students and the general public.

One such activity was the North Carolina Arboretum's "Lunch with a Scientist" event. Laura Stevens joined K–8 grade students participating in the ecoEXPLORE program. The students gathered for lunch with several scientists in order to expand their breadth of knowledge related to local ecosystems and the environment. The students were eager to learn about weather and climate, including how instruments are used to measure the weather and how weather and climate data is recorded and analyzed, both now and in the past. They perused a 19th century weather journal and discovered how to keep their own weather log at home.

In addition to special events and science fairs, NCICS staff make multiple visits to elementary and middle school classrooms throughout the year and interact with educators on a regular basis. In October, Carl Schreck participated in the Buncombe County Professional Development Day. This district-wide initiative provided 6th–12th grade teachers with information and tools to help them in the classroom. Carl presented to two groups of 25 teachers each who were interested in learning more about climate change, hurricanes, and North Carolina's weather and climate.

Photo: Our most well-attended outreach event of the year: Jared Rennie talks to 200 students at North Buncombe Elementary's Career Day about how NCICS analyzes weather and climate data.

AGU 2017 and AMS 2018 Meetings

Institute scientists and staff were involved in more than 30 sessions, presentations, and posters at the 2017 Fall Meeting of the American Geophysical Union (AGU), which took place December 11–15 in New Orleans. Research topics ranged from the human health impacts of climate to the microphysics of precipitation. Other topics included changing snow cover over Russia, customer use cases for NOAA NCEI datasets, and a new automated algorithm for detecting weather fronts in climate model data. For a complete list of our AGU activities, see the web story "NCICS at AGU 2017" at https://ncics.org/news/events/ncics-at-agu-2017. And be sure to watch our website and social media for details on our participation at the 2018 annual meeting of the American Meteorological Society in Austin, Texas, on January 7–11, 2018.

Climate, Weather, and the Great American Eclipse

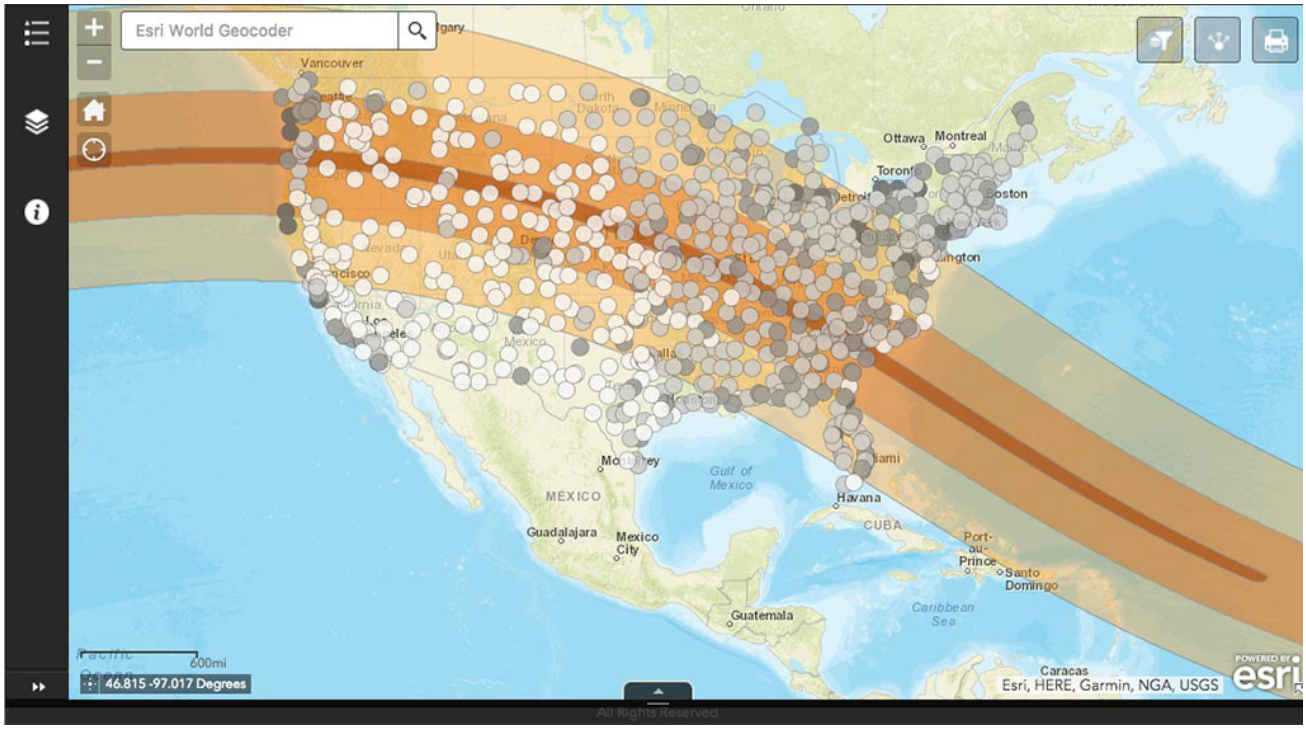
On August 21, 2017, a total solar eclipse swept across the continental United States from the Pacific Northwest to the South Carolina coast. Several months prior to the big day, scientists and communication experts from NCICS and NOAA NCEI were busy exploring how historical climate data could help eclipse-seekers identify the best locations for viewing the eclipse.

The result was an interactive, web-based map (https://ncics.org/cics-news/eclipse-viewability-map) showing the probability of experiencing clear skies at hundreds of weather station locations around the country on the date and time of the eclipse. Using historical cloudiness data from NOAA NCEI's 10-year hourly climate normals dataset, the team developed a formula that calculated the probability of viewability at each station, based on the hourly average occurrence of five types of cloud cover: clear (no clouds), few, scattered, broken, and overcast. Higher percentage values indicate a higher likelihood of having clear skies.

The GIS-based map also included overlays showing the path of totality as well as zones of 90% and 75% obscuration. This allowed enthusiasts to identify locations in the path of totality with the best chances of having clear skies. Users could also click on an individual station to see details about the eclipse at that location as well as a bar chart showing the probabilities for each of the five types of cloud cover.

The web map and accompanying stories on both the NCEI and NCICS web sites proved to be very popular, resulting in more than a dozen stories in national and local media outlets and more than 300,000 views of the web tool.

The connections between the eclipse, climate, and weather don't stop there. Institute scientists are currently analyzing weather data from August 21 to see how closely the actual conditions that day matched the viewability projections derived from the historical averages (sneak peek: the climatological forecast did well across most of the country). The team is also looking at how the eclipse actually affected local weather conditions as it swept across the country. Watch our website and social media feeds in the coming weeks for more details.



Our interactive eclipse viewability map showed the likelihood of clear skies on the date and local time of the August 21, 2017, solar eclipse for stations around the country based on hourly average cloud cover data from NOAA NCEI's 10-year hourly climate normals dataset. Lighter circles indicate a higher probability of clear skies while darker circles indicate a lower probability for clear skies. You can explore the map yourself at: https://ncics.org/portfolio/monitor/eclipse-2017

Engagement

NCICS/CICS-NC supports NOAA NCEI's sectoral engagement activities, helping expand and understand the uses and applications of environmental information and advancing science by gathering needs and requirements. Recent engagement activities focused on the energy sector, the health sector, and infrastructure, where NCICS's Jenny Dissen was involved in organizing several events and collaborating with public and private sector partners.

"The Climate Resilient Grid: A Forum on Energy, Climate and the Grid," held June 14–15, 2017, convened thought leaders from the energy industry, government, and academia to demonstrate the impact of climate on the energy business, the value of environmental intelligence in the renewable energy market, and the importance of solution providers using environmental data to develop industry- and customer-relevant renewable solutions. Organized by the American Meteorological Society Committee on Climate Services, CASE Consultants International, NOAA NCEI, and CICS-NC, the forum brought expert speakers from industry, including Duke Energy, National Grid, SCANA, and Philadelphia Gas Works, and from solution providers, such as the Brattle Group, ICF, Statweather, the Resilient Grid, and Secure Futures to name a few. NCICS's Jessica Matthews gave a presentation on "Next Generation Environmental Intelligence for the Solar Industry" featuring the new GOES-16 satellite data. For more information on the forum, visit http://www.caseconsultantsinternational.com/events.html#the-grid.

NCICS also collaborated with CASE Consultants International in organizing "Climate and Respiratory Health—Focus on Asthma," held on November 9, 2017. This workshop explored the impact of weather and the environment on respiratory health. NCICS's Kenneth Kunkel and Jesse Bell were among the key speakers discussing climate change in the context of respiratory health and the effects of environmental triggers, such as smoke, dust, and fungal spores, on asthma attacks. For more information, including copies of the presentations, see: http://www.caseconsultantsinternational.com/events.html#focus-asthma.

NCICS was also involved in organizing the symposium "Game-Changing Resilient infrastructure" held on June 22, 2017. This education symposium organized by CASE Consultants examined how green and resilient infrastructure is changing communities and addressing impacts of climate change. More details are available at: http://www.caseconsultantsinternational.com/events.html#game-changing.

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